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C-A OPERATIONS PROCEDURES MANUAL

15.10.2.4 Procedure for Handling and Disposal of Sodium and Rubidium from Optically Pumped Polarized Ion Source

(Preinjector Systems/LINAC Group Procedure LN042)

Note: This document was formerly a C-A Group Procedure. The content of the group procedure was reviewed by the Technical Supervisor. All approvals and/or issue dates of the original group procedure are maintained for present use.

Hand Processed Changes

<u>HPC No.</u>	<u>Date</u>	<u>Page Nos.</u>	<u>Initials</u>
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COLLIDER-ACCELERATOR DEPARTMENT

Title: Procedure for Handling and Disposal of Sodium and Rubidium from Optically Pumped Polarized Ion Source (OPPIS)

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LN042 -Procedure for Handling and Disposal of Sodium and Rubidium from Optically Pumped Polarized Ion Source (OPPIS)

1. Purpose

To detail the proper procedure for the safe handling and disposal of sodium and rubidium used in the Optically Pumped Polarized Ion Source (OPPIS).

2. Responsibilities

- 2.1 Preinjector group personnel trained in the handling and disposal of sodium and rubidium are responsible for compliance.
- 2.2 Line supervisors are responsible for determining who should be allowed to dispose the sodium and rubidium.

3. Prerequisites

3.1 Training

- 3.1.1 Hazard Communication Training (IND200).

4. Precautions

Caution:

Sodium and Rubidium react violently when in contact with water.

- 4.1 Only authorized personnel are allowed to perform the following procedure. Unauthorized personnel will be restricted from the area where the procedure will be performed during handling of sodium or rubidium.
- 4.2 The disposal procedure must be carried out in a fume cupboard.
- 4.3 Two people are required to perform this procedure. The second person should act as a safety watch and provide general assistance.
- 4.4 The handling of sodium and rubidium prior to loading the charge exchange cells must be performed in a glove box under a nitrogen atmosphere.
- 4.5 An eye wash station must be within the general vicinity of where the procedure will be conducted.
- 4.6 A class D (combustible metals) fire extinguisher must be easily accessible.
- 4.7 A face shield, gloves, and an apron, must be worn when transporting the sodium or rubidium cell, and when cleaning a cell.

5. Procedure

5.1 The following steps detail the loading of the rubidium cell:

- 5.1.1 The following equipment is required to perform this procedure: Class D (combustible metals) fire extinguisher, face shield, ampoule of rubidium, scribe, rubidium loading cylinder, heat gun.
- 5.1.2 Move the class D fire extinguisher next to the glove box.
- 5.1.3 Transfer a 25g ampoule of rubidium wrapped in bubble wrap into the glove box.
- 5.1.4 Once the proper equipment has been assembled in the glove box, purge the atmosphere in the glove box with nitrogen for 10 minutes.

Note:

If there are any signs of smoking or oxidation of the rubidium, discontinue the loading procedure and continue the nitrogen purge.

- 5.1.5 In the glove box, heat the ampoule of rubidium with a heat gun until the rubidium melts. Scribe and break the ampoule. Pour the rubidium into the loading cylinder.
- 5.1.6 Once the rubidium loading cylinder is loaded with rubidium, transport it to the OPPIS source and connect it to the copper feed tube that allows the rubidium to enter the charge exchange cell.
- 5.1.7 Heat the charge exchange cell, copper tube and loading cylinder to 50°C.
- 5.1.8 Use the loading cylinder to push the rubidium into the charge exchange cell.
- 5.1.9 Allow the charge exchange cell, copper tube and loading cylinder to cool.

5.2 The following steps detail the loading of the sodium cell:

- 5.2.1 The following equipment is needed to perform this procedure: Class D (combustible metal) fire extinguisher, face shield, bulk sodium, knife, sodium storage cylinder, glove box, heat, tray.
- 5.2.2 Move the class D fire extinguisher next to the glove box.
- 5.2.3 Open the sodium container outside the glove box. Remove the plastic bag containing the sodium from the metal container and place it in the glove box.

- 5.2.4 Purge the atmosphere of the glove box with nitrogen for 10 minutes before starting this procedure.

Note:

If there are any signs of smoking or oxidation of the sodium, discontinue the loading procedure and continue the nitrogen purge.

- 5.2.5 Place the sodium on a tray in the glove box. Cut a piece of sodium weighing approximately 150 g from the bulk material in the glove box.
- 5.2.6 Place this sodium in the sodium storage cylinder and connect it to the sodium reservoir.
- 5.2.7 Heat the storage cylinder until the sodium is liquid and naturally flows into the sodium reservoir.
- 5.2.8 Once the sodium reservoir is loaded, cover the opening and transport it to the OPPIS source.
- 5.2.9 Reassemble the sodium reservoir in the OPPIS source and re-establish vacuum conditions as quickly as possible.
- 5.3 The following steps detail the procedure for the disposal of sodium:
- 5.3.1 The following equipment is needed to perform this procedure: Class D (combustible metals) fire extinguisher, face shield, sodium storage cylinder, steamer, large beakers, pH paper, HCl acid, squeeze bottle of water, sheet metal, metal tray, gloves, apron.
- 5.3.2 Move the class D fire extinguisher next to the fume cupboard.
- 5.3.3 Purge the atmosphere in the glove box for 10 minutes.
- 5.3.4 Wear a face shield, gloves and an apron, transport the sodium reservoir to the glove box.
- 5.3.5 Connect the storage cylinder to the sodium reservoir and remove excess material from the reservoir by heating and allowing the sodium to flow into the storage cylinder.
- 5.3.6 Remove as much excess material as possible in the glove box. Collect this material and dispose of whatever can not be reused as detailed below.
- 5.3.7 Transport the reservoir to the fume cupboard and turn on the fan.

- 5.3.8 Turn on the steamer and wait until it only produces dry steam. Use the steamer to remove any remaining material from the cells. Collect all of the waste and water.
- 5.3.9 Lower the door of the fume cupboard as low as practical and then use a piece of sheet metal to prevent any splattering of material. Place the smaller parts and collimators to be cleaned on a metal tray. Using a squeeze bottle of water, direct a stream of water at the parts to be cleaned. Again the wastewater must be collected and disposed of as below.
- 5.3.10 Neutralize the water collected in the previous steps with HCl. pH paper should be used to determine when the solution is neutralized. It can then be disposed of in the drain, flushing with water afterwards for 1 minute.
- 5.4 The following steps detail the procedure for the disposal of rubidium:
 - 5.4.1 The following equipment is needed to perform this procedure: Class D (combustible metals) fire extinguisher, face shield, squeeze bottle of water, piece of sheet metal, large beakers, pH paper, HCl acid, metal tray, gloves, apron.
 - 5.4.2 Move the class D fire extinguisher next to the fume cupboard.
 - 5.4.3 Wearing a face shield, gloves and an apron, transport the rubidium charge exchange cell from the OPPIS area to the fume cupboard.
 - 5.4.4 Turn on the fans of the fume cupboard.
 - 5.4.5 Lower the door of the fume cupboard as low as practical. Use the piece of sheet metal to prevent splattering of any material. Place the parts to be cleaned on a metal tray. Keeping as much distance as possible between you and the rubidium cell use the squeeze bottle to direct a stream of water on the cell and the various parts. This water and waste material must be collected and disposed of as detailed below.
 - 5.4.6 Once the reactions have finished, rinse the various cell parts with deionized water.
 - 5.4.7 Neutralize the water collected in the previous steps with HCl. pH paper should be used to determine when the solution is neutralized. It can then be disposed of in the drain, flushing with water for 1 minute.

6. **Documentation**

None.

7. References

None.

8. Attachments

None.